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Agricultural Memorandum No 867

LAMB MORTALITY

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Introduction

The studies of lamb mortality in a commercial lowland sheep flock, described in Agricultural Memorandum No's 835, 845, 849 and 865 have shown a correlation between the weather and lamb mortality. The work demonstrated that a smaller lambs chance of survival was reduced if its heat loss exceeded a critical value during its first 24 hours out at pasture. The average values for lamb mortality, when these conditions were exceeded, were 14.5% for lambs weighing less than 3kg and 5.2% for lambs between 3 - 5kg. The evidence also suggested that lambs were susceptible to periods of high heat loss, over 24 hours, during a much longer period. The statistics showed a significant correlation between the two for lambs which had been out on the pasture for up to 10 days.

In order for the agro-meteorologist to give management advice on the effect of the weather on lamb mortality it is necessary to take these experimental findings and relate them to environmental conditions in the sheep farming areas in Great Britain.

Considerations

Several factors must be taken into account before the topic is dealt with in detail. Firstly the lambs in the experimental work were housed for their first 24 hours. This period is critical as far as survival is concerned because the small lambs have not had time to build up any energy reserves and as a result they are not well equipped to encounter periods of high heat loss. The critical heat loss (CHL) chosen for this work is relevant to animals which have been initially housed and a lower level may well be appropriate for lambs born from outside. Secondly the lambs used in the experiment, mainly Mules, Cadzows, Scots Cross's and $\frac{1}{2}$ bred, had fine birth coats and were less likely to withstand the rigours of the weather than the coarse haired sheep farmed on the hills.

Calculations

Data by Alexander (1964) have been used to express the environmental variables in terms of heat loss for young lambs. The heat loss at lamb height has been calculated for ten meteorological stations using the hourly observations of temperature, wind-speed and rainfall. These stations were chosen to give a reasonable coverage of the sheep farming areas of Great Britain but for some areas eg central Wales, detailed meteorological observations were not available. Figure 1 gives the distribution of sheep in England and Wales and the location of the meteorological stations.

General solution of the heat loss equation

Agricultural memorandum 865 demonstrated that with a heat loss of 80 X the basal metabolic rate lambs were more likely to die due to weather induced stress. This value has been taken for the CHL in this paper. To demonstrate the meaning of this in meteorological terms Alexander's equations have been solved and critical regions with respect to temperature and windspeed have been derived, see figure 2. Lambs,

FH2B

especially if they are wet, are clearly likely to experience these critical conditions if they are born during the Winter or Spring period. It is therefore necessary to determine quantitatively the number of occasions when these conditions occur.

Solution of heat loss equations for 10 meteorological stations

Table 1 gives the average number of occasions that the CHL is reached per month for each of the ten stations. It also shows the effect of the cold, wet winter and spring of 1979.

Figure 3 (a,b,c) expresses the number of times that the CHL is reached for various periods of time in terms of years out of 10.

The experimental work also demonstrated that a high heat loss during the lambs first ten days on pasture was an important factor in its chances of survival. Therefore a farmer may not only require to know the number of days when it is unwise to put newborn lambs out into his fields but he may also require to know the chances of his lambs undergoing a period of high heat loss during a ten day period. To determine this for each year and station a sampling window of 10 days, starting on January 1st was moved in one day steps until May 31st. For each window position the number of occurrences that the CHL was reached was counted (M). As the window was moved along a frequency distribution was built up. Table 2 shows these distributions. Thus between January 1st and May 31st, at Mountbatten, on average there are 23 ten day periods with one or more CHL periods and on 4 of these occasions two CHL periods would fall in the same ten days. Thus if lambs were put out into the fields daily, at Mountbatten, from January 1st to May 31st there are 23 sets of lambs which would have been subjected to a high heat loss.

Application of heat loss data to other areas

It is extremely difficult to make an accurate assessment of the number of days when the CHL is reached for an area other than one for which hourly values of temperature, windspeed and rainfall are known. The only way to arrive at an approximate number is to assume that the conditions at the desired site bear some form of relationship with the nearest site for which the three parameters are known. Figure 1 has demonstrated that, within certain limits, the most critical factor is the state of the lambs coat and this is the most difficult of the variables to ascertain. If a relationship can be ascertained for the number of hours with rain between the required area and a known site and that the temperatures and windspeed are equal at both places it may be possible to apply a correction factor to the known CHL data. This would at least give only an approximate answer and on many occasions an underestimate as many areas where sheep are farmed are far more exposed than the areas for which heat loss data are available.

Summary

The meteorological conditions which led to mortality in a lowland sheep experiment have been shown to be present, to varying degrees, at each of the ten chosen sites.

Acknowledgements

I am most grateful for the help afforded to me during the project by Dr J Starr. Any comments or suggestions on this paper should be referred to the author.

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Met O 8a Bracknell
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References

Alexander G (1964) Lamb Survival: physiological considerations Proc. Australian Soc. of Anim. Prod 5 113 - 122.

FIG 1 Sheep distribution & Meteorological stations

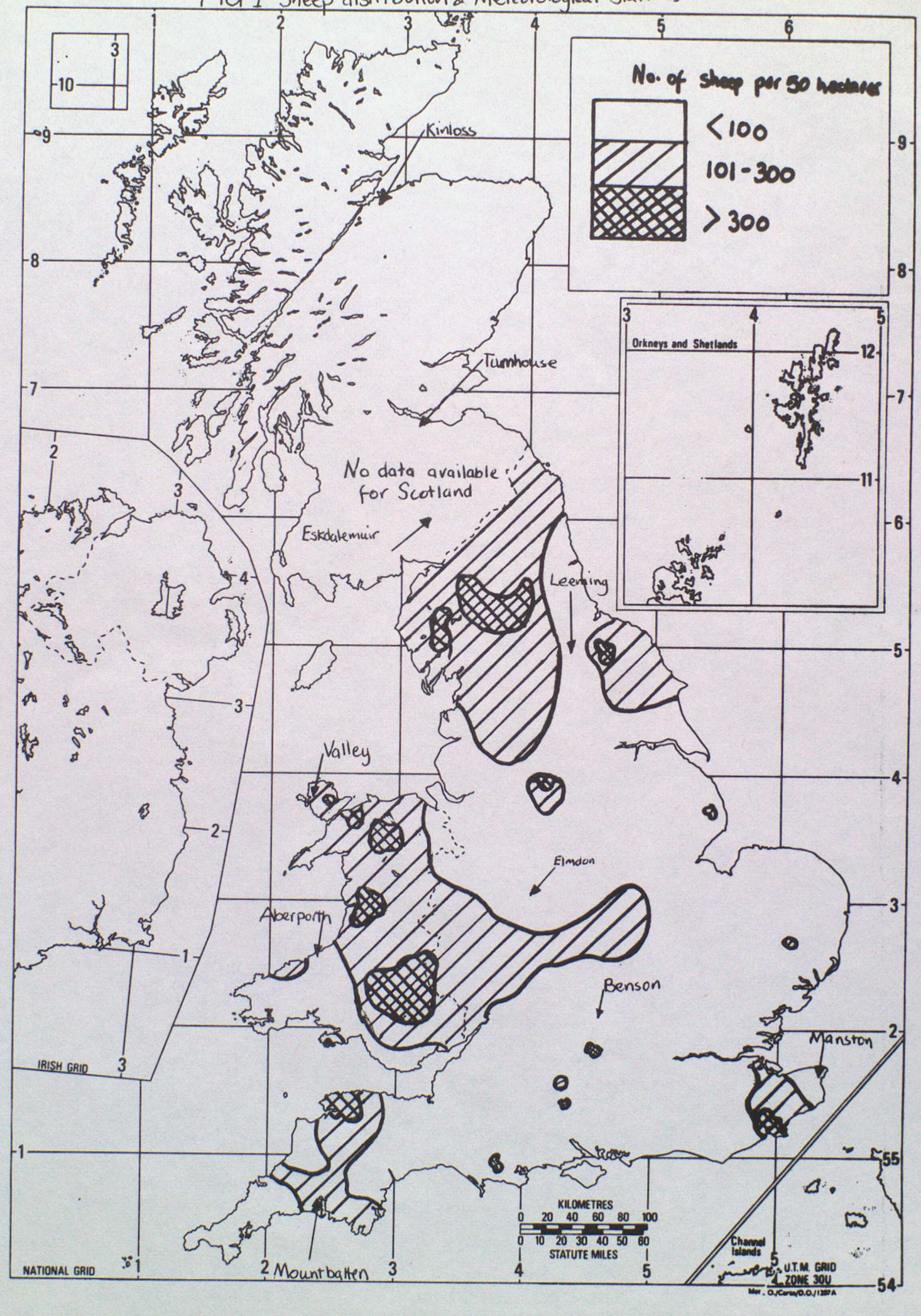


Figure 2. CRITICAL CONDITIONS FOR NEWBORN LAMBS.

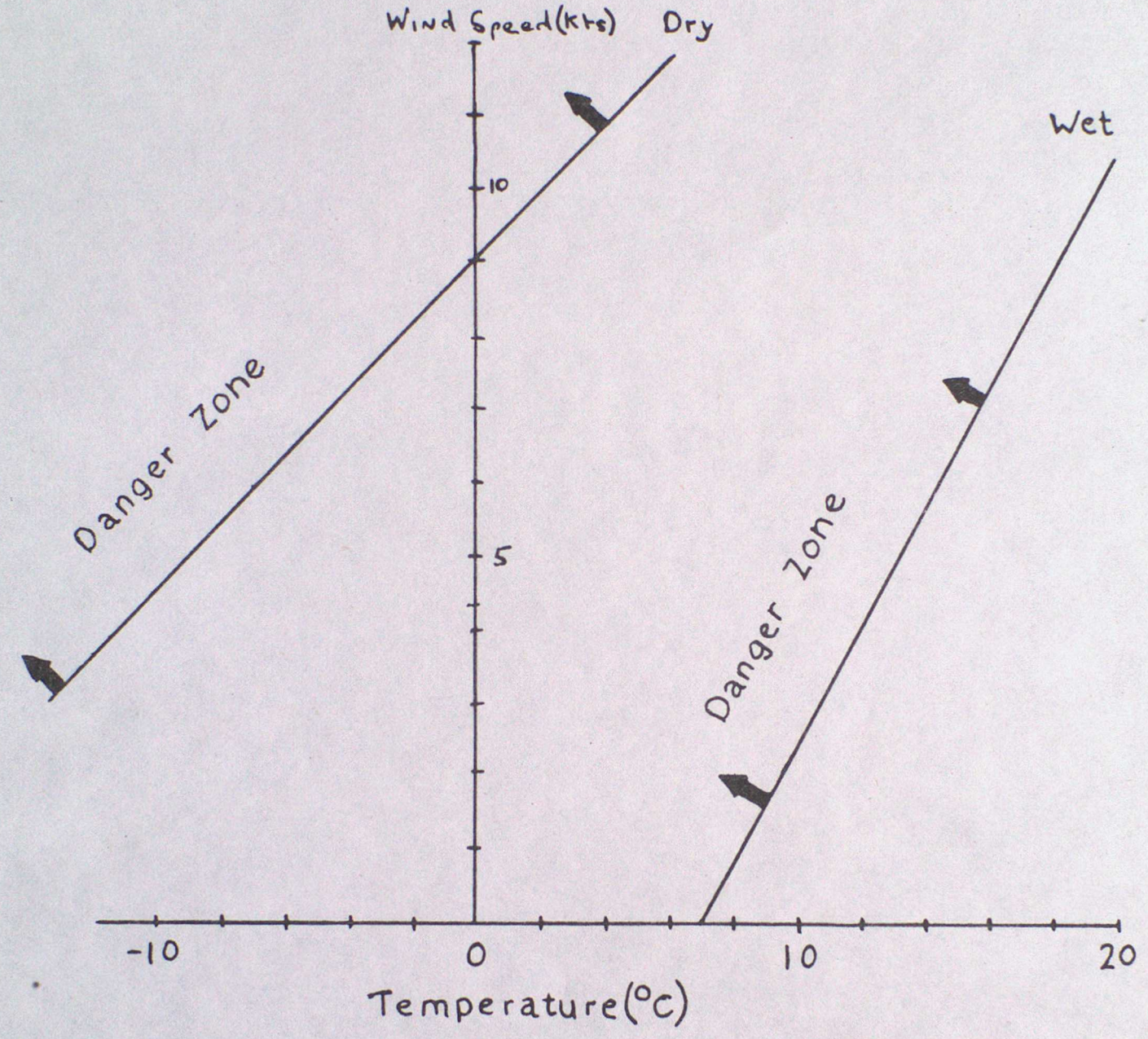


FIG 3 (a)

No. weather off years in the North CHL is reached.

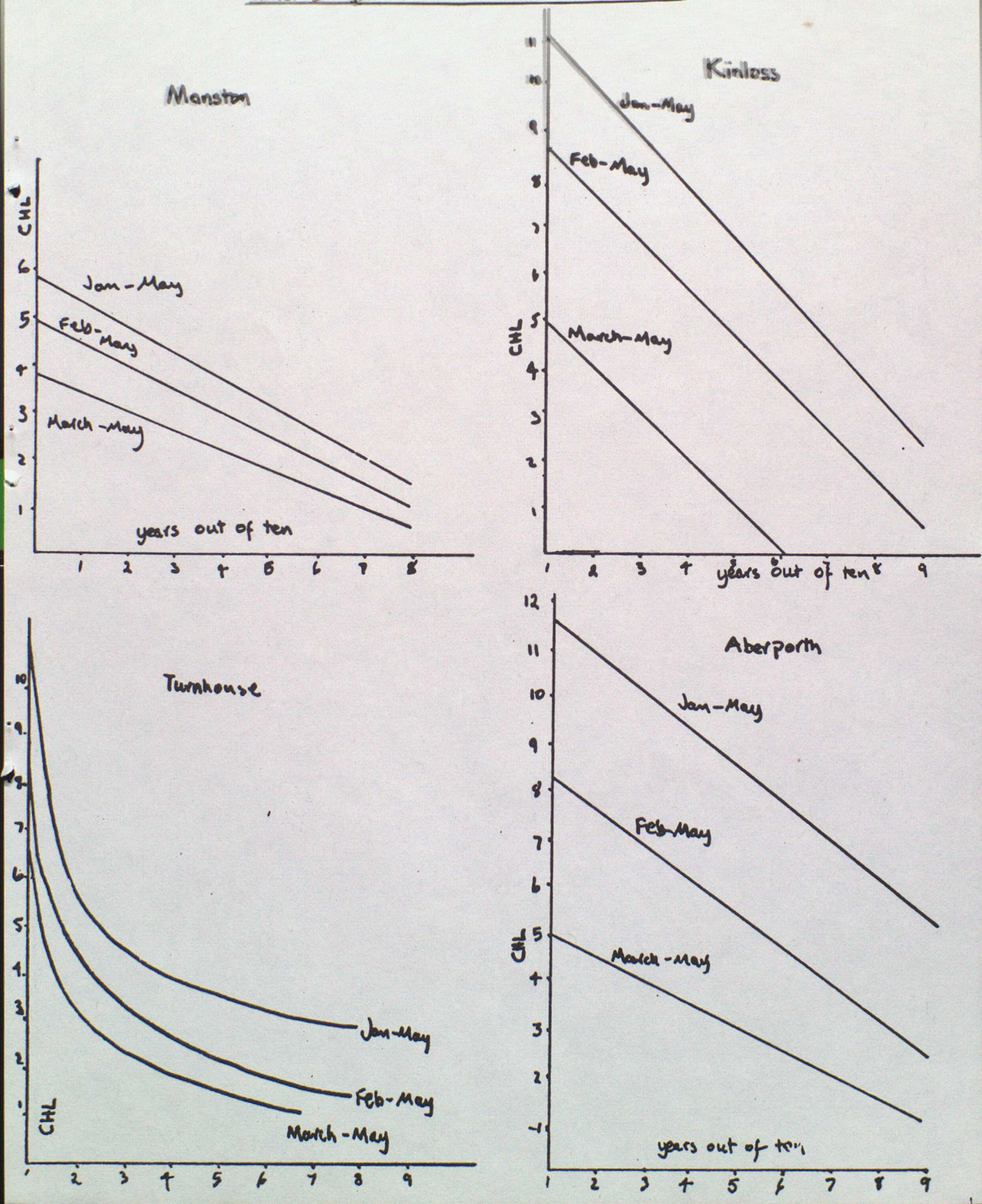
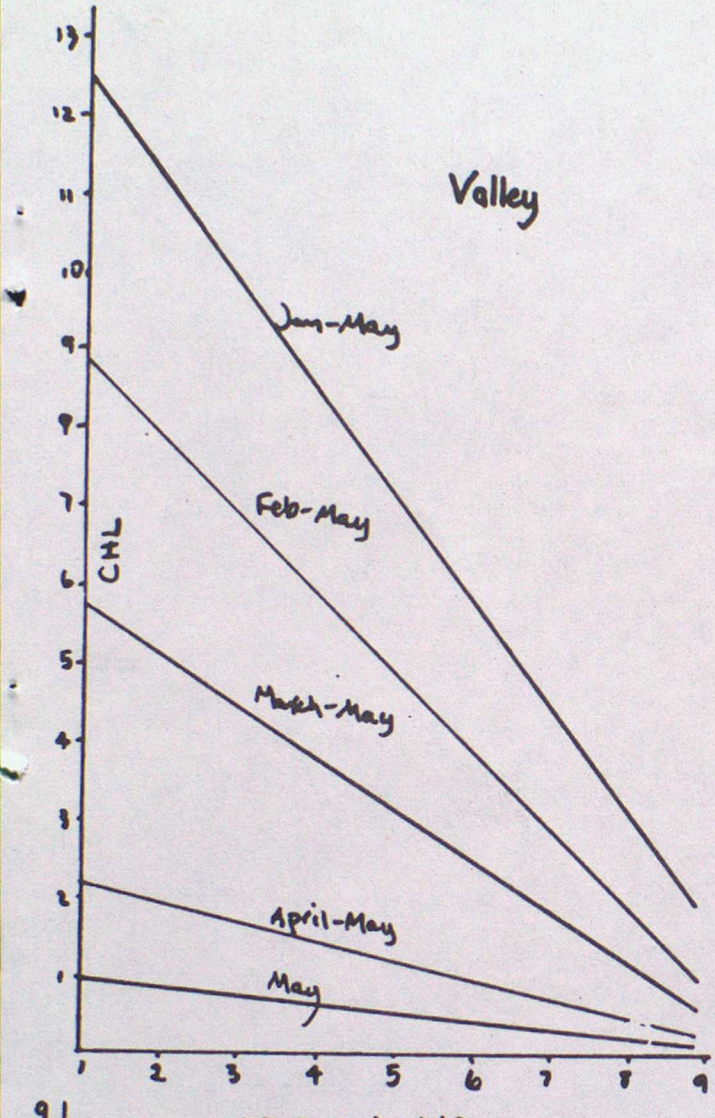
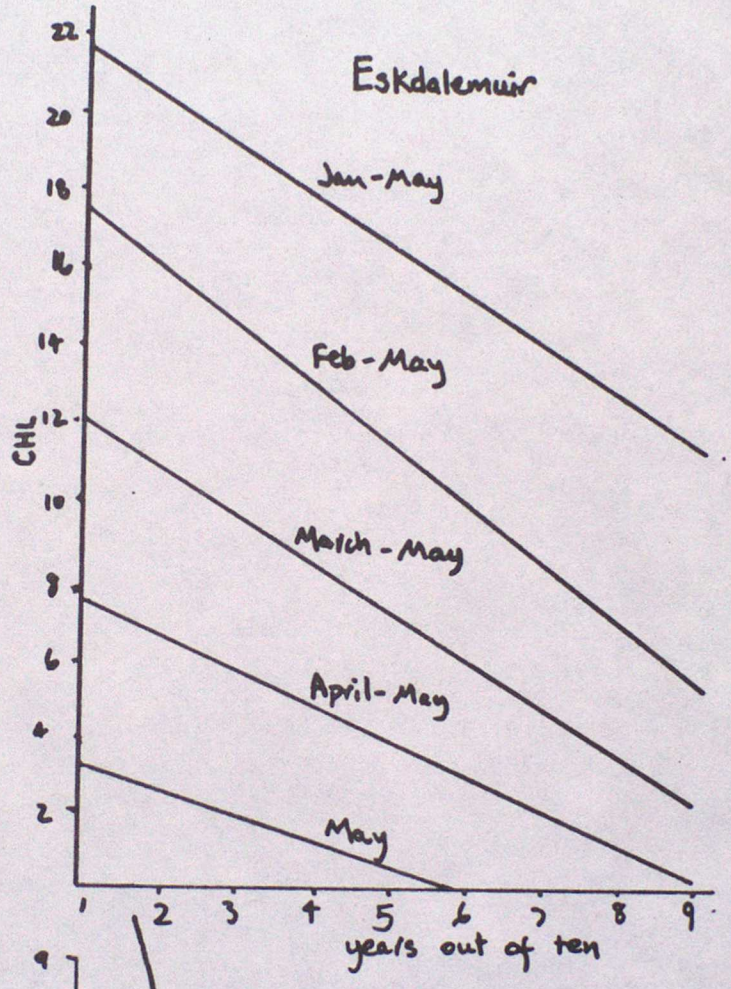
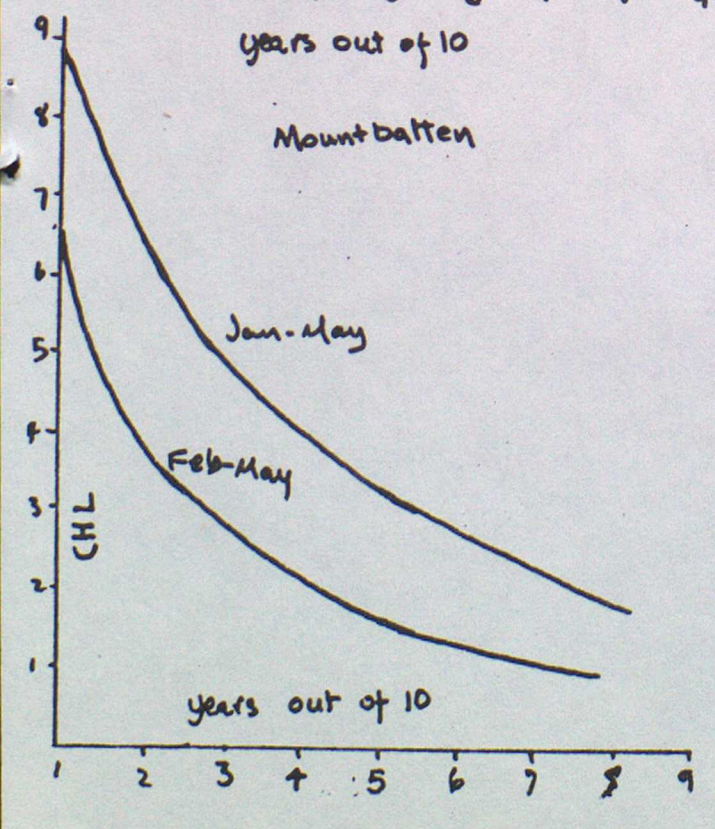


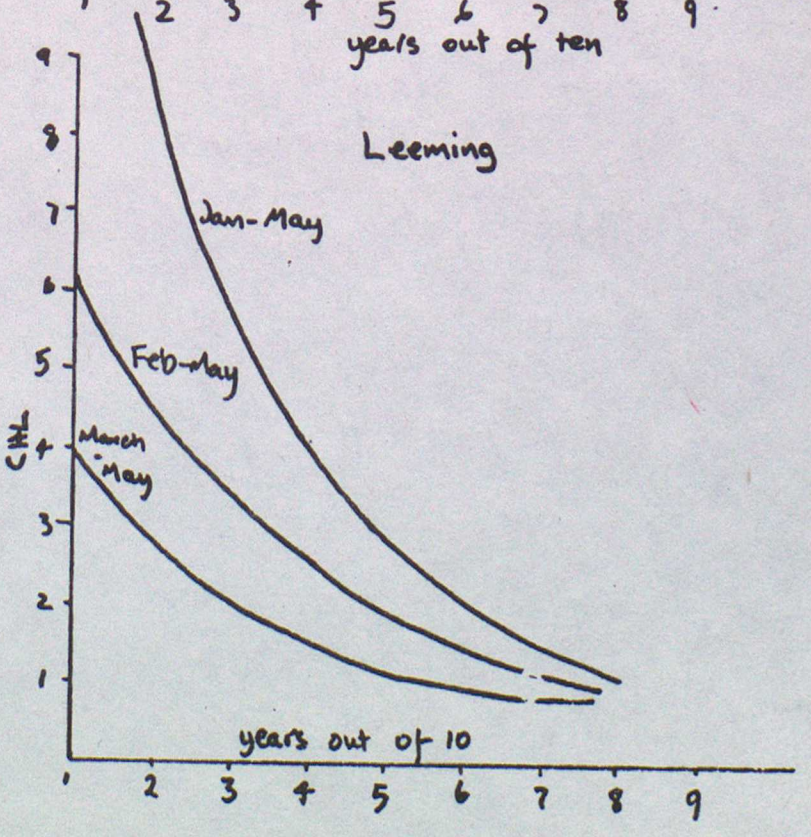
FIG 3 (b)

Number of years in ten that CHL is reached.









Elmdon

FIG 3 (c) Number of years in ten that CHL is reached.

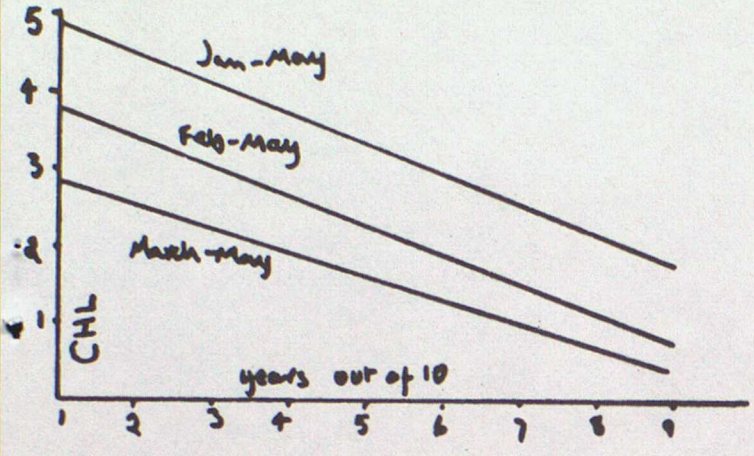


Table 1 Number of CHL days per month

Station	Month	Average	1979	Station	Month	Average	1979
Mountbatten (1959–78)	Jan	1.4	3	Valley (1959–78)	Jan	2.1	3
	Feb	0.9	0		Feb	1.5	4
	March	0.6	1		March	1.5	5
	April	0.3	0		April	0.8	0
	May	0.0	0		May	0.1	0
Manston (1965–78)	Jan	0.9	5	Leeming (1966–78)	Jan	1.2	4
	Feb	0.7	2		Feb	0.8	2
	March	0.8	2		March	0.9	5
	April	0.5	0		April	0.6	0
	May	0.0	0		May	0.0	0
Benson (1975–78)	Jan	0.8	3	Eskdalemuir (1957–75)	Jan	5.1	3
	Feb	0.0	3		Feb	3.8	5
	March	0.3	4		March	3.1	14
	April	0.0	0		April	1.7	1
	May	0.3	0		May	0.7	0
Aberporth (1959–78)	Jan	2.9	5	Turnhouse (1959–78)	Jan	1.0	1
	Feb	1.8	5		Feb	1.3	2
	March	1.2	3		March	0.8	6
	April	0.5	1		April	0.5	1
	May	0.1	3		May	0.2	0
Elmdon (1959–78)	Jan	1.0	3	Kinloss (1959–78)	Jan	1.7	0
	Feb	0.7	4		Feb	1.6	0
	March	0.6	3		March	1.3	2
	April	0.3	0		April	0.8	1
	May	0.0	0		May	0.3	1

Table 2 Heat loss in ten day period

Station	Period	M ≥1	≥2	≥3	≥4	≥5	*
Mountbatten (1959–78)	Jan–May	23	4				23/152
	Feb–May	12	2				12/121
	Mar–May	5					5/92
	Apr–May	1					1/61
	May–May						0/31
Manston (1965–78)	Jan–May	22	3				22/152
	Feb–May	14	2				14/121
	Mar–May	8	1				8/92
	Apr–May	3					3/61
	May–May						0/31
Benson (1975–78)	Jan–May	12					12/152
	Feb–May	5					5/121
	Mar–May	5					5/92
	Apr–May	2					2/61
	May–May	2					2/31
Aberporth (1959–78)	Jan–May	41	12	4			41/152
	Feb–May	25	5	1			25/121
	Mar–May	12					12/92
	Apr–May	4					4/61
	May–May	1					1/31
Elmdon (1959–78)	Jan–May	21	4				21/152
	Feb–May	13	2				13/121
	Mar–May	7	1				7/92
	Apr–May	2					2/61
	May–May						0/31

Station	Period	M ≥1	≥2	≥3	≥4	≥5	*
Valley (1959–78)	Jan–May	36	12	3			36/152
	Feb–May	23	6	1			23/121
	Mar–May	14	4	1			14/92
	Apr–May	5	1				5/61
	May–May	1					1/31
Leeming (1966–78)	Jan–May	25	5	1			25/152
	Feb–May	17	3				17/121
	Mar–May	10	2				10/92
	Apr–May	3					3/61
	May–May						0/31
Eskdalemuir (1957–75)	Jan–May	67	36	17	6	2	67/152
	Feb–May	45	22	9	3	1	45/121
	Mar–May	27	12	5	2	1	27/92
	Apr–May	12	3	1			12/61
	May–May	3					3/31
Turnhouse (1959–78)	Jan–May	27	5				27/152
	Feb–May	18	4				18/121
	Mar–May	9	2				9/92
	Apr–May	5	1				5/61
	May–May	1					1/31
Kinloss (1959–78)	Jan–May	34	11	4			34/152
	Feb–May	24	9	3			24/121
	Mar–May	14	4				14/92
	Apr–May	4	1				4/61
	May–May						0/31

* M/ Total number of days

M average number of occasions, in a ten day period, that 1 – 5 periods of CHL occur.